

duct. Its theoretical composition he gives as—titanic acid, 74.55; lime, 25.45; or CaO , 2TiO_2 .

IN his recent annual address to the "Geologische Reichsanstalt" at Vienna, Ritter von Hauer gives some interesting particulars regarding the steps that have been taken to investigate the geological structure of Austria's last territorial acquisition. On the occupation of Bosnia and Herzegovina, the Government requested the director of the Reichsanstalt to make a geological reconnaissance of these provinces, which had formed until that time an almost totally unknown tract of Europe, though their area at least equalled that of Bohemia and Saxony combined. Their rough mountainous character and want of means of communication and transit made the task by no means a light one. An original plan of co-operation with the Geological Survey of Hungary had to be abandoned on account of the want of disposable force in that service, and the work was accordingly undertaken by three members of the Austrian Survey, Messrs. Mojsisovics, Tietze, and Bittner, with some assistance from Prof. Pilar of Agram, and from previous labours of M. Paul in the saliferous region of Tuzla. As the result of this reconnaissance, an outline geological map of Bosnia and Herzegovina has been prepared on the basis of the sheets of the map of Central Europe issued by the Austrian Military Geographical Institute on the scale of 1:100,000. Eighteen tints of colour are employed, and with these are shown Alluvium and Diluvium, Calcareous tuff, Sarmatian, Marine and Freshwater Neogene, Trachyte, Flysch (Younger Flysch-sandstone, Nummulite-limestone, and limestone of the Flysch zone), Eruptive rocks of the Flysch-zone (Serpentine and Gabbro), Chalk-limestone, Jurassic Aptychus-limestone, Jura-limestone, Triassic (principally limestone and dolomite), Werfen shales, Red sandstones and quartzites, Palæozoic shales, sandstones, and limestones, and granite. The map is being reduced to the same scale as von Hauer's well-known and most useful general geological map of the Austrian-Hungarian Monarchy, and will soon be published by Hölder of Vienna, as a supplement to that work.

PHYSICAL NOTES

PROF. O. N. ROOD communicates to the current number of the *American Journal of Science* a new method of studying the reflexion of sound waves. The "tremolo" effect in some American organs is obtained by a revolving fan. Prof. Rood conceives that the alternations of loudness in the sound produced by this fan are not due, as is commonly supposed, to the fluctuations of air-currents which it produces, but to the rapid alternations of reflexion and non-reflexion at its surface. A disk of zinc having sectors cut out of it, rotating in its own plane, yielded similar results. Using such disk as a reflector, when rotating at from two to four revolutions per second, and observing the intensity with which these alternations are produced, Prof. Rood obtains some interesting results. At a perpendicular incidence the short sound-waves are more copiously reflected than those that are longer, and the regular reflexion is more copious from large than from small surfaces. When the sound-waves fall upon small plane surfaces at an acute angle, the reflexion is most copious in the same direction as with a ray of light, but the reflected and inflected waves can be traced all around the semicircle. The reflexion being more intense for waves of short wave-length, the components of a composite sound-wave are not all equally copiously reflected at the same angle. The reflexion of sound from very small surfaces is easily demonstrated by this method. Qualitative comparisons between the power of different substances to reflect sound can easily be made by this method. Thus a disk of cardboard in which the open sectors are covered with filter-paper gives alternations owing to the difference in reflective power between the zinc and the filter paper.

QUICKSILVER may be readily frozen by placing a small quantity of it along with anhydrous ether in the decanter used for freezing water of a Carré's freezing-machine, and exhausting in the usual manner. This experiment is due to M. de Waha.

PROF. COLLADON of Geneva, has been studying the instrument invented by Rhodes, of Chicago, and named the audiphone, whose purpose is to aid the deaf in hearing. The newest form of this instrument, as imported from America, consists of a thin flexible sheet of hard ebonite rubber, provided with a handle like a palm-leaf fan, and with a cord which can be tightened at pleasure to curve it into the form of a semi-cylinder. The edge of the sheet is pressed against the upper set of teeth, as

described in a recent "Note," the convex surface being outwards, and so the vibrations impinging upon the sheet are transmitted through the teeth and bones of the skull to the auditory nerve. Prof. Colladon finds that the sheet of ebonite may be advantageously replaced by a sheet of fine elastic cardboard, the best kind being that smooth, dense variety known to the trade as *shalloon* board or satin board (*carton d'orties*). This card audiphone costs but a trifling fraction of the ebonite article, and is on all hands admitted to yield a better result. Some experiments conducted in January by M. Colladon and by M. Louis Sager upon deaf-mutes leave no doubt of the existence of cases in which, while the ordinary hearing-trumpet fails, the audiphone is successful. M. Colladon mentions the case of a professional singer who had been deaf for fourteen years, to whom the audiphone of cardboard brought back once more the power of hearing the music of a piano. It is an interesting point in M. Colladon's observations that persons deaf-mute from birth evinced emotions of a pleasurable nature on thus hearing music for the first time.

THE variations of the refraction-constant with elevation above the earth's surface have recently been studied by Herr von Sterneek (*Sitzungsber.* of Vienna Academy, vol. lxxx. div. 2), who took measurements (mostly by day and only in calm weather) of the zenith distances of stars of known declination, at eleven different stations in Styria, Upper Austria, and Bohemia, with various heights up to 2,500 m. The meteorological conditions were carefully recorded. The values of the refraction-constant α calculated from these observations, tabulated with the meteorological data, are compared with the values α' deduced from Bessel's refraction-constant at 0° temperature and 760 mm. air-pressure. The differences are in general not great, but seem to have a certain regularity. The author finds neither the height of the place of observation, nor the temperature, related to these differences, but the conditions of *moisture* seem to be intimately connected with them. If this connection be represented graphically, it is found that, in general, a moister atmosphere corresponds to the positive differences $\alpha - \alpha'$, than to the negative. Taking these differences as ordinates, the psychrometric differences as abscissæ, the points form almost a straight line, which cuts the axis of abscissæ at about 4° psychrometric difference. Hence the values deduced from Bessel's constant agree with the observed only with a psychrometric difference of 4° ; with a smaller difference they are less, with a greater, greater. While not giving these results as absolutely decisive, the author thinks they should awaken some interest, as several phenomena known to observers seem to point to an influence of moisture on refraction, too much neglected, since Laplace affirmed it to be quite insignificant.

O. E. MEYER has recently shown, by careful measurement of the intensity for different groups of rays of the spectrum, that ordinary daylight contains relatively a greater proportion of red and yellow rays, and a less proportion of blue and violet rays than the direct light of the sun.

NEWTON denoted by the name of "indigo" the tint of the spectrum lying between "blue" and "violet." Von Bezold, in his work on colour, rejects the term, justifying his objection by observing that the pigment indigo is a much darker hue than the spectrum tint. Prof. O. N. Rood, who follows von Bezold in rejecting the term, brings forward the further objection that the tint of the pigment indigo more nearly corresponds in hue (though it is darker) with the cyan blue region lying between green and blue. By comparing the tints of indigo pigment, both dry and wet, with the spectrum, and by means of Maxwell's disks, it appears that the *hue* of indigo is almost identical with that of Prussian blue, and certainly does not lie on the violet side of "blue." Indigo in the dry lump, if scraped, has, however, a more violet tint; but if fractured or powdered, or dissolved, its tint is distinctly greenish. Prof. Rood considers that artificial ultramarine corresponds much more nearly to the true tint of the spectrum at the point usually termed "indigo," and he therefore proposes to substitute the term "ultramarine" in its place, the colour of the artificial pigment being thereby intended.

PROF. W. F. BARRETT has recently come to the conclusion that the phenomenon of the Trevelyan "rocker," which has been hitherto regarded as produced by the rapid expansion and contraction of the metals in contact, is due rather to the action of a polarised layer of gas between the hot and cold surfaces like that existing between the hot and cold surfaces of the layer of vapour supporting a drop of liquid in the spheroidal state,

and termed a "Crookes's layer" by Mr. G. J. Stoney. The Trevelyan rocker appears, therefore, to be a true heat-engine.

M. E. SARASIN has been continuing the work begun by M. Forel, of observing the phenomenon of the *seiches* of the Swiss lakes. In pursuit of this object he has constructed a registering limnimeter of a more portable form than those of MM. Forel and Plantamour. Instead of digging in the bank of the lake a well communicating with the deep water, M. Sarasin employs a tube of zinc about 35 centims. in diameter, and 150 centims. long. This is fixed vertically to about half its depth in the lake, against a wall or jetty, and communicates with the water by a narrow tube descending to a considerable depth, thus avoiding the fluctuations of mere waves. The support which holds the tube also carries a pulley over which a ribbon of copper passes, having at one end the float, at the other a counterpoise. The axis of the pulley passes into a separate case containing a registering apparatus, in which a pencil rests upon a sheet of paper which is carried forward at the rate of one millimetre per minute by clock-work. This portable limnimeter when placed for comparison beside the fixed limnograph of M. Plantamour at Sécheron, gave identical indications. It was then set up at the Tour de Peilz near Vevey, in order to observe the oscillations at a station further east than those previously selected. The researches of M. Forel had shown the existence of long oscillations of 73 minutes' duration, due to uninodal waves along the length of the lake from Geneva to Villeneuve, and of shorter oscillations of 35 minutes' period, due to a binodal oscillation in the same direction. The former were observed, though not markedly, at the Tour de Peilz, and were found to be in almost exact opposition of phase to those simultaneously registered at Sécheron, and in agreement with those at Morges. The binodal waves of 35 minutes coincide in phase at Vevey with those at Sécheron. These were observed to possess extreme regularity, the exact mean period being 35.6 minutes. Other oscillations with a period of 5 to 6 minutes were observed, and are attributed to transverse oscillations in the lake from Vevey to St. Gingolphe. As was observed at Morges, the new limnograph indicated incessant small oscillations due to the passage of steamboats; the first morning boat from Villeneuve could be thus detected by the oscillations produced from 12 to 15 minutes before its arrival. These observations leave no doubt of the general correctness of M. Forel's theory, and establish two points hitherto requiring confirmation; firstly, that the movements of oscillation observed at the two ends of the lake are precisely similar in type, being opposite in phase for uninodal waves, but identical in phase for binodal waves; secondly, that the oscillations of 35 minutes' period are due to binodal waves, not as was at one time thought possible to oscillations occurring in the transverse dimensions of the lake.

OUR contemporary, the *Electrician*, states that the following process for utilising old india-rubber, of which many hundred tons are thrown away as waste-substances, has just been patented in Germany. The rubber waste is subjected to distillation in an iron vessel over a free fire, with the aid of superheated steam. The lighter oils which come over first are separated from the heavier products. The latter when thickened and vulcanised in the usual manner, are found to possess all the good qualities of first-class natural rubber.

MR. J. E. H. GORDON points out, in the pages of a contemporary, that Silone is the real inventor of a form of Thomson electrometer, recently attributed to Herr Edelmann. This "improved" instrument had the usual flat brass quadrants replaced by a metallic cylinder slit longitudinally into four parts, within which the "needle" was placed. Silone's instrument, which was described in *Poggendorff's Annalen* for 1875, was used for determining the specific inductive capacity of liquids, and the quadrants were of tinfoil pasted inside a glass cylinder.

GEOGRAPHICAL NOTES

PROF. NORDENSKJÖLD in a short paper to the Paris Academy of Sciences, gives a list of the collections obtained during his recent expedition, which are to be arranged and described on his return to Stockholm. There are numerous observations on climate, magnetism, auroræ, hydrography, geology, fauna, flora, ethnography, &c. Among the collections is a very rich collection of invertebrates taken during the numerous dredgings of Dr. Stuxberg in the Glacial Ocean; to judge from these dredgings, the fauna richest in individuals, at the depth of 30 to

100 metres, is not to be found in the tropics, but only in the Glacial Ocean and Behring Strait; yet here the temperature at bottom is always 1° to 2° C. below zero. Collections of phanerogams, lichens, and algæ were made by Dr. Kjellman and Dr. Almquist; masses of bones of sub-fossil whales of the Chukchi penin ula and of *Rhytina stelleri* of Behring Island; a very fine collection of tertiary fossil plants from Nagasaki and Labuan; this collection is expected to afford information on the former equatorial climate and on the ancient centres of dispersion of the present floras. Cut stones, utensils, arms, dresses, &c., of Chukchis and Eskimo; the latter at present use both weapons of stone and the Remington rifle. This collection contains among other things drawings, engravings, and sculptures in ivory, which have much resemblance to the palæolithic designs of France. Lastly, there is a collection of 1,040 works in 5,000 or 6,000 volumes of Japanese books and MSS., printed or written before the opening of the country to Europeans. The *Vega* left Naples for Lisbon and Portsmouth on Sunday.

SURGEON-MAJOR H. W. BELLEW has lately collected, from native authorities, some useful information respecting Kafiristan, that interesting country which no European has so far succeeded in exploring. It appears that it is, after all, only about 150 miles in length, by about 50 or 60 in breadth, and its boundaries may be taken as the Hindu Kush on the north, including both the northern and the southern slopes, from Latkoh Darra on the east, to the Farajal valley on the range separating it from Panjshir, on the west; the Chitral River, down to Chaghansarae, or even Kunar, on the east, forms its limit in that direction, while the southern boundary may be taken to be a line from Darra Nur, on the east, to Tagao on the west; and on the west it is bounded by the Nijrao and Panjshir valleys. The whole area is mountainous and furrowed by a succession of long winding valleys, each of which has its own system of branches and glens ramifying into the recesses of the mountains. From information which Dr. Bellew derived from a native of the country, there appears to be "nowhere room to gallop a horse." Dr. Bellew, besides the topographical information which he has brought together, has extended his researches into the subject of the manners and customs, &c., of the Kafirs, and the results of his investigations make us regret all the more that Major Tanner was last year compelled to abandon his intended visit to Kafiristan.

THE March number of the Geographical Society's monthly periodical contains Mr. G. J. Morrison's papers on his journeys on the Grand Canal and Yellow River, and from Hankow to Canton overland, followed by Dr. Emil Holub's account of his last expedition in South Central Africa from the Diamond Fields to the upper waters of the Zambesi, the former illustrated by two maps, on one sheet, of parts of Eastern China. The geographical notes comprise some interesting remarks on the climate of Zanzibar, which it behoves intending travellers in East Central Africa to study carefully, a summary of proposals for a survey of Southern Africa, and the results of Lieut. R. C. Temple's observations on the distribution of the Afghan tribes about Candahar. The rapid progress of the Berlin Society of Commercial Geography is also alluded to. A memorandum by Mr. Alfred Simson on the boundaries of Ecuador will be found to contain matter of considerable geographical interest. We observe that in the April number we are promised a map illustrating Dr. Holub's South African journeys and Sir Michael Biddulph's valuable topographical notes on the eastern border of Pislim and the basin of the Loras in Afghanistan.

IN reference to a note in a recent issue, it is interesting to learn that a company of squatters is being formed in Western Australia, with the object of at once occupying the magnificent tract of country on the Fitzroy River, which has recently been discovered by Mr. Alexander Forrest. It is intended to take stock there, and to endeavour to cultivate tropical products.

THE Berlin Society of Commercial Geography is rapidly assuming considerable importance. As we have before recorded, it was started about a year ago, and now numbers some 1,500 members. It already has several affiliated branches among German communities in different parts of the world, and issues two periodicals. One of these, which is of a scientific nature, appears twice a month, while the other is purely commercial, and is published every week.

MR. JAMES CAMERON appears to be one of the most indefatigable of the active members of the China Inland Mission. It